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The pilot malaria vaccine program in Marindi Sub-County Hospital, Homa Bay, Kenya

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ABSTRACT

Effective malaria control programs prevent transmission of malaria by promoting personal protective measures like the use of mosquito repellent creams, the use of mosquito net/coils, promoting effective vector control strategies like indoor residual spraying, and the provision of appropriate case management with early diagnosis and effective treatment. The Malaria vaccine is the proposed potential additional tool to complement the existing package of the WHO-recommended preventive, diagnostic, and treatment measures for malaria. Marindi Sub-County Hospital is one of the pilot sites where the Malaria Vaccine Program is being implemented in Kenya. Assessing the performance of the program is crucial in gauging the progress of the pilot program, identifying gaps/challenges, and formulating ways of addressing those challenges. We reviewed the records of children attending the Child Welfare Clinic (CWC) of the Marindi Sub-County Hospital and determined the number of children eligible for the malaria vaccine and those who got vaccinated between October 2019 and March 2020. 68.8% of the eligible children was vaccinated during this period. The malaria vaccine program is yet to pick up well due to various challenges and is expected to take shape as the implementation continues if the proposed measures are put in place. To improve the situation, there is the need for more sensitization (using the local language and through some contextually relevant channels), on the job training for healthcare workers, the astute dissemination of relevant information to all and sundry and to make more vaccines available to the program and localities.

INTRODUCTION

Malaria is a disease caused by the Plasmodium parasite and is transmitted through infected mosquito bites. *Plasmodium falciparum* is the deadliest malaria parasite for humans, and it is the most prevalent in Sub-Saharan Africa. There are more than 200 million cases globally, and approximately 400,000 deaths annually despite the remarkable progress between 2000 and 2015 (World Health Organization [WHO], 2019). Those who are at risk of the disease are approximately 2 billion, and it is estimated that there is one malaria death every 20 to 30 seconds (Kumar, 2006).

In Kenya, malaria remains a public health concern since 19% of outpatient health consultations are of malaria, and *Plasmodium falciparum* accounts for 99 percent of all malaria infections in Kenya, even though all the four species of Plasmodium that infect humans also occur in Kenya (United States Agency for International Development [USAID], 2019). Kenya has been stratified

into four epidemiological zones for malaria control. These are endemic areas, highland, and epidemic-prone areas, seasonal malaria transmission areas, and low malaria risk areas (USAID, 2019).

Effective malaria control programs prevent transmission of malaria by promoting personal protective measures like the use of mosquito repellent creams, the use of mosquito net/coils, promoting effective vector control strategies like indoor residual spraying, and the provision of appropriate case management with early diagnosis and effective treatment (WHO, 2020). Kenya has been implementing these malaria control strategies, including indoor residual spraying biannually, and appropriate case management.

Even though there is a reduced malaria burden, over the past few years, progress in combating malaria has stalled. Reaching the Global Technical Strategy for Malaria (GTS) goal of a 90% reduction in malaria case incidence and death rates by 2030 may not be possible. There is, therefore, a near-consensus, globally, that there should be an effective use of existing tools, increased financial resources, and the need for new tools to get malaria control back on track (WHO, 2018). To this end, the Malaria vaccine is the proposed potential additional tool to complement the existing package of WHO-recommended preventive, diagnostic, and therapeutic measures for malaria (WHO, 2020). Marindi Sub-County Hospital is one of the pilot sites where the Malaria Vaccine Program is being implemented in Kenya.

The hospital is a level four health facility that handles referral cases from health centers and still provides primary health care services. It is located in the Homa Bay County, in the Nyanza region, the western part of Kenya, along the shores of Lake Victoria. This is a malaria-endemic zone, and there are high cases of malaria infections in the region with a prevalence rate of 27%, estimated 3.5 million cases which are the primary cause of hospital attendance, contributing to approximately 30% of admissions with more than 10,000 deaths annually (Tabu, 2018).

Assessing the performance of the pilot malaria vaccine program is crucial to gauging the progress of the pilot program, identifying gaps/challenges, and formulating ways of addressing those challenges.

THE CONCEPT OF THE MALARIA VACCINE

The malaria vaccine, also referred to as RTS,S/AS01 (RTS,S), is a vaccine that stimulates the body to produce antibodies that act against *Plasmodium falciparum* antigens and is recommended by WHO for the pilot program in selected high-burden areas of three African countries namely Ghana, Kenya, and Malawi. The vaccine is being evaluated for use as a complementary malaria control tool that could be added to, and not considered to replace, the core package of the WHO-recommended preventive, diagnostic, and therapeutic measures (WHO, 2018).

Candidates who are eligible for the malaria vaccination are children who come for the routine Expanded Program on Immunizations (EPI) with a schedule of the first dose at six months with the subsequent two doses one month apart and the fourth and last dose administered at the child's second birthday.

The phase 3 trial has been conducted for over five years, from 2009 to 2014, in seven sub-Saharan Africa countries. The vaccine prevented approximately 39% cases of malaria and about 29% cases of severe malaria with significant reductions of hospital admissions due to malaria among the children who received the four doses over four years of follow up. There was also a 29% reduction of the need for blood transfusions, which are usually needed to treat life-threatening malaria anemia (WHO, 2019).

The Malaria Vaccination Implementation Program (MVIP) was established to support the pilot implementation of the malaria vaccine through the routine immunization programs. WHO provides overall coordination to the MVIP and technical support to the ministries of health in the pilot countries. GlaxoSmithKline responsible for manufacturing the malaria vaccines will donate up to 10 million doses of the vaccine and will lead additional studies to monitor vaccine effectiveness and safety in routine use while PATH, a non-profit organization, provides project management and technical support and is leading studies on utilization of healthcare, and the economics of vaccine implementation (WHO, 2018).

The vaccine has parts of the surface coat of the parasites called sporozoite and induces immunity, and this impairs these parasites' capacity to complete their development in the liver, making them less capable of multiplying in the blood (Molyneux, 2016). This vaccine has been developed after several years of research and successful trials. Before its development, there have been suggestions of other strategies for malaria control by killing the malaria parasites in humans using vaccines or killing the parasites in the mosquito by the use of transmission-blocking vaccines (Dimopolous, 2006), in addition to possible weapons to fight malaria: drugs that kill the parasites in humans, an insecticide that kills the mosquito vector (Jacobs-Lorena, 2006).

THE ACTION PLAN FOR THE MALARIA VACCINE PILOT PROGRAM

The Malaria Vaccine Pilot Program has four doses of vaccines scheduled at six months, seven months, nine months, and a booster dose at 24 months. The use of the vaccine is not recommended in younger children between

six to twelve weeks, as the vaccine efficacy was found to be low in this age category. The pilot will go on for at least 30 months. The vaccine is administered along with other scheduled vaccines (Tabu, 2018). There will be sensitization of caregivers, community leaders, and health care workers. It is suggested that strong community relations and local engagement have the potential transparency, autonomy, and respect for the work of researchers, strengthening the pilot study (Berg et al., 2019). There will also be outreaches in North Kabuoch, the furthest area within the catchment area of the Marindi Sub-County Hospital.

MALARIA VACCINE PROGRAM IN HOMA BAY COUNTY

The Ministry of Health launched the Kenya Malaria Vaccination Implementation Program in Homa Bay County, which is one of the malaria-endemic regions along the shores of Lake Victoria. The Marindi Sub-County Hospital is one of the health facilities in Homa Bay County that were selected to implement MVIP. The hospital started delivering malaria vaccines in mid-September 2019 after the Launch. The program has a primary register that captures relevant information about the malaria vaccine.

768 children attended the CWC from October 2019 to March 2020 (Table 1). Out of this number, 528 (68.8%) children were vaccinated during the period (Table 2). The six-month-old children who attended the CWC in October 2019 were less than the number indicated to have received the vaccine at six months. The numbers do not tally across the months for all the targeted age groups. The Nursing officer-in-charge clarified that any child who came within that month and was seven or eight months old received the first dose of the vaccine. The second doses in the month of October were issued to those children who received the first dose in September since the facility started vaccinating in mid-September. The upside is that all the six-month-old children who attended the CWC in the month of October received the vaccination (Table 1).

The attendance of six-month-olds and 9-month olds appear to be higher than that of seven-month-olds (Table 1) probably due to the scheduled routine six-month Vitamin A supplementation and measles vaccination injection (jab) for the 6-month HIV exposed infants and the measles vaccines for all the nine-month-old children. The caregivers do not bring the 24 month-old children to the CWC despite the requirement that the children be brought to the clinic until they are five years of age. The majority of parents/guardians stopped bringing the children after the nine-month measles vaccination. In the months of February and March, there was a short supply of malaria vaccines due to logistical challenges in the wake of the COVID-19 pandemic. Therefore, not all eligible children have received the malaria vaccine as required (Table 2).

Table 1
Children who attended CWC

Period	Children who attended the Child Welfare Clinic (categorized by the age)				Total
	6 months	7 months	9 months	24 months	
October 2019	78	40	61	7	**186**
November 2019	73	30	55	0	**159**
December 2019	31	35	51	0	**97**
January 2020	30	31	49	0	**110**
February 2020	42	27	32	3	**104**
March 2020	37	22	30	3	**79**
Total	**291**	**206**	**278**	**13**	**768**

Source: *Child Welfare Clinic (CWC) Register*

Table 1 below indicates the number of children who attended the Child Welfare Clinic (CWC) as per the target ages.

Table 2
Children vaccinated

Period	No. of children who received the Malaria Vaccine				Total
	Dose 1	Dose 2	Dose 3	Dose 4	
October 2019	91	36	0	0	**127**
November 2019	73	50	0	0	**123**
December 2019	31	35	15	0	**81**
January 2020	30	32	48	0	**110**
February 2020	22	27	32	0	**81**
March 2020	10	10	3	3	**26**
Total	**237**	**190**	**98**	**3**	**528**

Source: *District Health Information (DHIS), 15th April 2020*

Table 2 shows the number of children who received malaria vaccines from October 2019 to March 2020.

PERCEPTION ABOUT THE MALARIA VACCINE

The nursing officer in charge of vaccination in the facility reported positive malaria vaccine acceptance. This concurs and resonates with the findings of six studies that were conducted in six different countries, including Kenya, that there would be positive acceptance of the malaria vaccine implementation (Dimala, 2018).

The nursing officer explained that when parents or guardians take their children to the CWC, they are given information on malaria vaccines during the morning health talks. There is also a banner in the CWC with simple messages on the vaccine. The responses from these parents during health talks show that they believe the malaria vaccine will bring added health benefits, and they hope that children will not be infected with malaria. Studies that were conducted in two endemic areas in Kenya before the pilot program also indicated that the parents were looking forward to the vaccination program being rolled out, and they hoped to get some relief from malaria infection (Ojakaa et al., 2011).

Marindi Sub-County Hospital is located in the malaria-endemic zone. According to a study, being a resident of the Western, Coastal Region, Nyanza, Central, and Eastern regions of Kenya is significantly associated with a higher likelihood of acceptance for child immunization. As expected, the study also found the highest number of malaria infections in the malaria-endemic regions of the Western and Nyanza regions and the Eastern region, which is a seasonal malaria transmission area. The study suggested that the high approval rate in these areas is likely to be related to the residents' wish to reduce the burden of malaria in their communities (Ojakaa et al., 2014).

CHALLENGES

At the time of the review, the program was yet to pick up well due to the following challenges:

The information on the number of children who received the malaria vaccine from October 2019 to March 2020 in comparison to the total number of children who attended the CWC during that period indicates that the facility is still struggling in the implementation of the malaria vaccination program. There is either poor documentation or the officers offering the services do not follow the guidelines. The other challenge is that there is an additional workload for the already constrained staff. Even though malaria vaccination has been integrated into the routine immunization, there is still an extra workload ("Field observation", n.d.).

Inadequate community engagement is a challenge to some extent. Even though the approval rate of the vaccination is high, women in some households within the area have no power to make decisions on what health services the children of that household must get during every clinic visit. Such decisions are made by the mothers-in-law or husbands ("Field observation", n.d.). The nursing officer in charge reported that not much was done on community engagement apart from reaching out to community health volunteers who were, in turn, to reach out to households. Village leaders, household heads like mothers-in-law/husbands, and other influential people in the community were not fully engaged, so this could lead to some missed opportunities. Studies suggest that lack of inadequate community engagement in any project could lead to undermining of the project's efforts (Angweny et al., 2014).

According to the nursing officer in charge, some parents who brought their children for the six month-appointment did not turn up for the seventh-month appointment, and when they were asked during the nine-month appointment why they did not turn up, they cited the fear of side effects of the vaccine after their children developed fever, and further explained that this is a new vaccine that the children's bodies have not yet 'familiarized with.' Some studies show that some parents do not come back for subsequent vaccinations for fear of side effects and also if the children develop fever or abscess, especially if it is a new vaccine (Bingham, 2012).

Other challenges that the program faces is the distance that some mothers have to travel to reach the CWC ("Field observation", n.d.). The nursing officer reported that some women have to walk for many kilometers and they genuinely say that they missed the previous month because they did not have transport money for the motorcycle, yet others (very few) reported that their religion only allows them to have their children vaccinated with the routine vaccines and not new vaccines or any vaccination done during an outreach.

Another possible challenge is misinformation, whereby the caregivers abandon other malaria control strategies by thinking that once the child receives the vaccines, he or she will not get infected. She cited malaria vaccine stock-outs, as was evidenced in the months of February and March 2020 (Table 2), health worker's attitude, and reduced clinic attendance after the nine months. According to a document, just as has been mentioned by the nursing officer, it agrees that some challenges include fear of side effects, long queues at the CWC, long-distance to vaccination centers, lack of inadequate supplies, poor communication between health workers and patients, and difficulties with vaccine storage (Dimala, 2018).

PROPOSED SOLUTIONS

We propose the following solutions to the identified challenges:

a) More sensitization sessions and on the job training for the healthcare workers at the CWC to offer adequate malaria vaccination and proper documentation
b) Engaging all the stakeholders, including influential community people, household heads, including male heads and mothers-in-law
c) Translating the critical messages about the vaccine into *Dholuo*- the local language, and using trusted sources to deliver health information.
d) The communication strategy to everyone, including caregivers, community leaders, and all stakeholders, should clarify questions in an easily comprehensible language to avoid any misconceptions about the vaccine.
e) Addressing the aspects that influence the decision of caregivers to have their children vaccinated.

Like in the issue of religion, proper communication strategy could be used, and leaders of such churches targeted to have them understand the role of malaria vaccines, have them buy it in, then ask them to pass the relevant information to their congregants just as a study proposes that addressing cultural issues including religion would be beneficial (Ojakaa et al., 2014).

f) Targeting specific segments of caregivers with relevant information. These segments include the less educated people, residents of villages with low acceptance rates, older caregivers, and even health care workers with relevant information (Ojakaa et al., 2011).

g) Considering redeploying staff by taking staff from less congested service delivery points like the antenatal care clinic to the CWC. This is the ideal solution because the county government is not employing any staff at the moment.

h) Arranging with the community health volunteers in difficult-to-reach areas so that once a month, vaccines are carried, using vaccine cold-chain carriers with ice packs to those villages to reach out to the children of targeted ages. Such has been practical in resource-constrained areas where vaccines need to be taken to remote areas like in The Gambia where the vaccines had to be taken to trial sites, about 20 kilometers from the storage center (Afolabi et al., 2014).

i) Integrating community engagement activities into already existing structures. There are community health volunteers who conduct community dialogue days to discuss health matters in the community. Messages and health talks on malaria vaccine could be embedded into such activities (Angwenyi, 2014).

j) Clear and effective health information should be delivered by the health workers to the caregivers in regards to fear of side effects (Meñaca et al., 2014).

These solutions could ease the challenge of inadequate community engagement and lack of the right information (Meñaca et al., 2014).

CONCLUSIONS

The malaria vaccine program is yet to pick up well due to various challenges and is expected to take shape as the implementation continues if the proposed measures are put in place. To improve the situation, there is the need for more sensitization (using the local language and through some contextually relevant channels), on the job training for healthcare workers, the astute dissemination of relevant information to all and sundry and to make more vaccines available to the program and localities.

Further research should aim to look into the burden of malaria in the vaccinated population.

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